Common Hadronic Final State Interaction Code

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The purpose of relativistic heavy ion collision is to study matters under extreme conditions. However in order to understand the result of relativistic heavy ion collision data, and to extract information of matters at the high density phase, one must also know the effect of hadronic final state interactions on the experimental observables. The proper treatment of hadronic final state is an important part of developing event generators for RHIC.

Experience from experiments at AGS and SPS energies has taught us that hadronic resonances contribute significantly to the strangeness production as well as the collective flow. Although large quantities of data are available about collisions among pions and nucleons, the interactions of resonances requires phenomenological modeling.

We have developed a hadronic cascade based on the General Cascade Program (GCP), and coupled it to several event generators for RHIC. Such a common hadronic after-burner helps us to isolate the effect of hadronic final state interaction and allows us to distinguish different physics at the high density phase from the final observables.

A useful hadronic after-burner must satisfy the following: include all stable hadrons and the low mass hadronic resonances; parameterize measured cross-sections for all energies; parameterize final state momentum distribution of each channel; preserve detailed balance for all interactions; and provide easy access to all the physics parameters. The last two items were rather unique to the hadronic after-burner we have constructed. The ability of GCP to handle many-body interactions means detailed balances can be maintained even for channels with three or more particles in the final state, such as the decay of ω meson. The code GCP is just a very efficient relativistic cascade engine plus necessary interfaces for building all types of cascade models, from parton cascades to hadronic cascades. Unlike other event generators, all physics content are tabulated input to GCP. One can test the validity of the code from simple input, so there is no hidden parameters inside the code. All the physics is external to the code and can be examined and changed easily.

Most of the inclusive cross-sections were obtained from the Particle Data Group and CERN-HERA [1] compilations. Many of these cross-sections can be parameterized by a simple analytic form which is valid from the threshold to the very high energies[2]. After each interaction the momentum distribution of the final state is sampled from the phase space with additional weighting factors to achieved the desired differential cross-section. There are modules in GCP for performing each of these tasks.

The effect of hadronic final state interaction on HIJING has been tested [3]. We have found that the hadronic after-burner significantly modifies the strange baryon spectra at SPS and RHIC.

References

[1] A. Baldini, V. Flaminio, W. G. Moorhead and D. R. O. Morrison, LB New Series, Volume **12**A and Volume **12**B, Ed. O. Madelung, (1988).

[2] Y. Pang, *Hadron-Hadron Interactions at Low and Intermediate Energies*, to be published.

[3] Y. Pang, S. Vance, and X. N. Wang, *HIJING with Hadronic Final State Interactions*, in preparation.

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